

Landfills and Groundwater Vulnerability

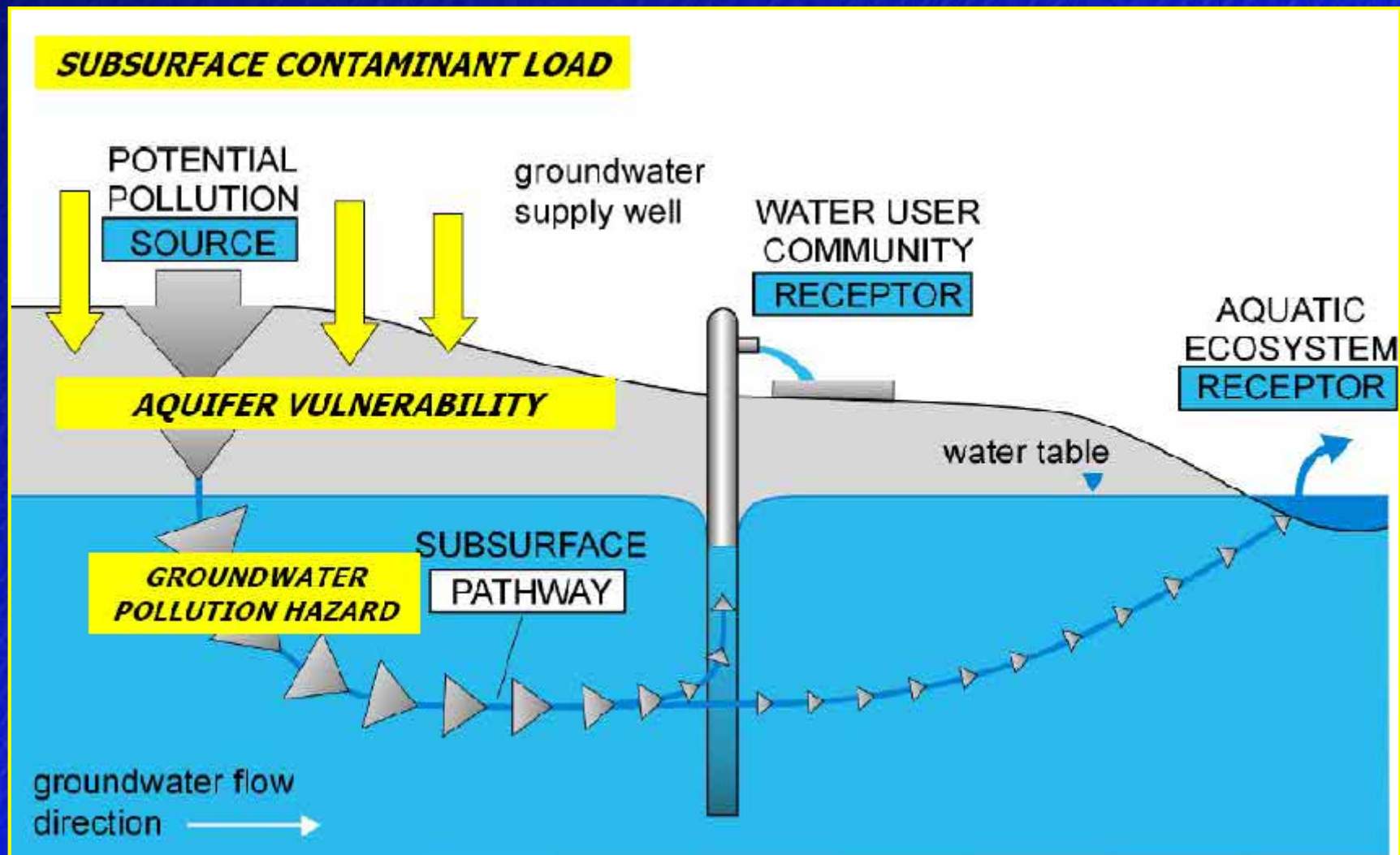
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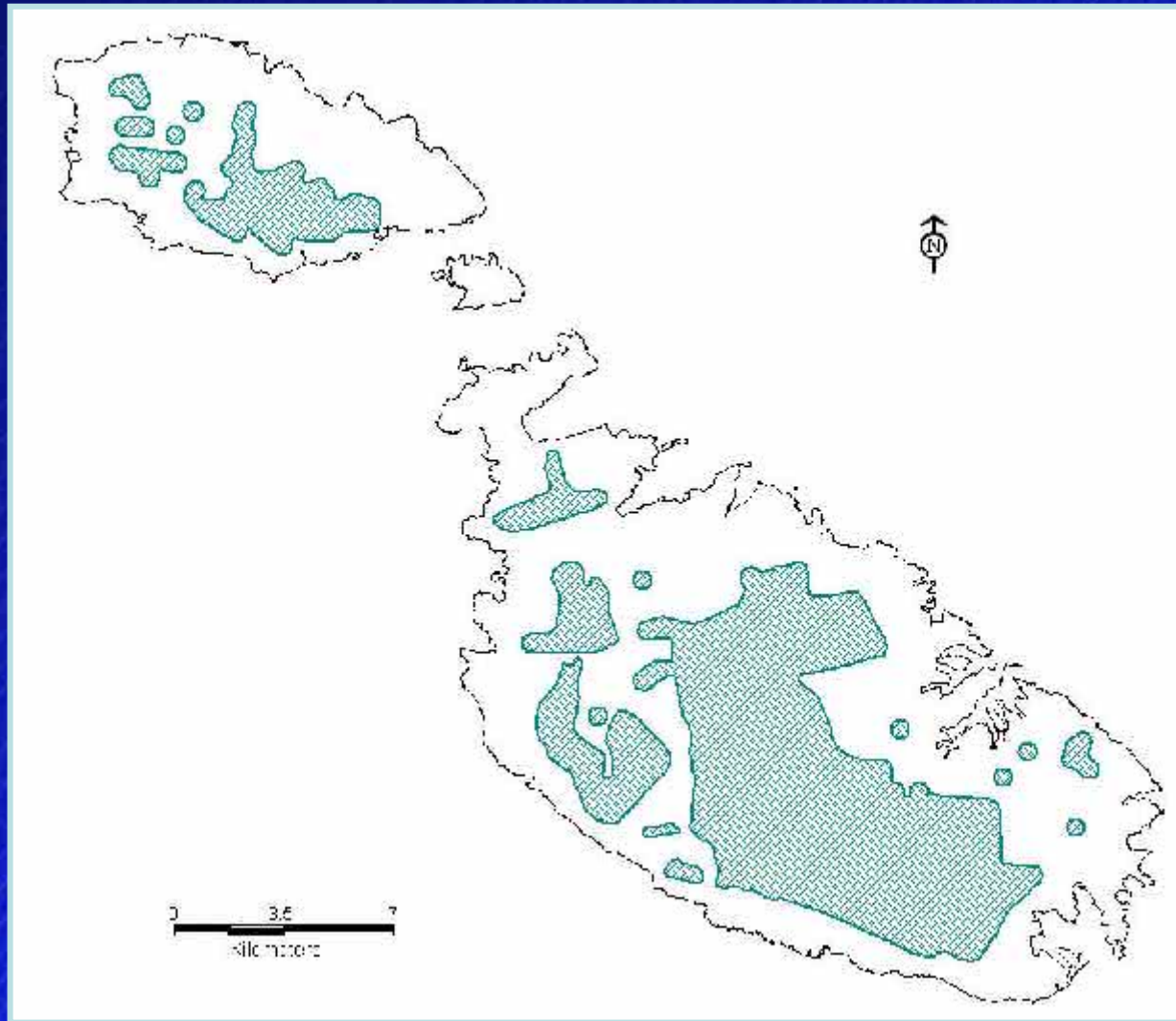


Defining Groundwater Vulnerability



Source: Malta Resources Authority, Water Directorate

Groundwater Protected Zone



The boundary of the Groundwater Protected Zone used as a tool for groundwater resource management

Source: Malta Resources Authority, Water Directorate

Importance of the unsaturated zone

The movement of water through the unsaturated zone can be **slow** through interconnected pore spaces. This provides for:

- Interception, adsorption and elimination of bacteria and viruses
- Attenuation of heavy metals and other inorganic compounds
- Adsorption and biodegradation of organic compounds

Importance of the unsaturated zone

Or it can be **fast** through fractures and fissures that enable the rapid movement of pollutants from the surface to the water table

Main concern with quarries or excavated areas utilised for landfilling is that this unsaturated protected zone is removed rendering the water table more vulnerable to pollution.

Groundwater Vulnerability

Water percolating through landfills produces **leachate**

Factors affecting the composition of landfill leachate and guidelines to MRA consultations:

- Landfill material
- Landfill conditions
- Characteristics of entering water
- Soil characteristics under the landfill

The risk of groundwater contamination by any leachate that is not caught by collection systems is determined by the following factors:

- Depth of the water table
- Concentration of contaminants
- Permeability of the geologic strata
- Type of geologic strata
- The toxicity of the contaminants
- The direction of groundwater flow

Past landfill activities

The **Scott Wilson** Report which looked at the Magħtab, il-Qortin and Wied Fulija Landfills describes in detail the potential impacts on local groundwater quality from leachate during the rainy season,

The study resulted in the finding of concentrations of:

- heavy metals,
- volatile and semi-volatile organic compounds
- dioxins

These were significantly elevated above Maltese background levels in exposed waste materials and combusted wastes on the dump.

Lower concentrations of heavy metals and dioxins were recorded in the soils surrounding the landfills.

No leachate was observed within the waste mass at Magħtab

Detected pollutants

The identification of potentially elevated concentrations of potential contaminants in groundwater was assessed by comparison with EU Council Directive 98/83/EC on the quality of water intended for human consumption. The following determinands were found to be elevated above the drinking water standards:

- iron;
- chlorides;
- sodium;
- manganese ;
- sulphate
- ammoniacal nitrogen
- total coliforms
- E.coli and
- *Bacillus stearothermophilus*

- Monitoring boreholes were also found to contain trace quantities of organotin (TBT)
- There was an absence of detected organic contaminants away from the immediate vicinity landfill

MRA Conditions

- The provisions of LN 168/2002 – Waste Management (landfill) Regulations (EPA)
- LN 128/97 Deposit of wastes and rubble (Fees) Regulations 1997
- EU Council Decision 2003/33/EC Council decision for the acceptance of waste at landfills

Conditions

- *“the landfill base and sides shall consist of a mineral layer which satisfies permeability and thickness requirements with a combined effect in terms of protection of soil, groundwater and surface water at least equivalent to: land-fill for inert waste: $K \leq 1.0 \times 10^{-7}$ m/sec; thickness greater than or equal to 1m. Where the geological barrier does not naturally meet the above conditions it can be completed artificially and reinforced by other means giving it equivalent protection.”*

Thank You